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**BIOLOGICAL REVIEW OF THE 1992  
TEXAS CLOSURE**

**BY**

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## Introduction

In 1981, the Gulf of Mexico Shrimp Fishery Management Plan (FMP) was implemented with the primary objective being to increase the yield of brown shrimp harvested from Texas coastal waters. Since then, various aspects of the Texas closure management measure have been analyzed and reported on by scientists at the Southeast Fisheries Science Center (SEFSC). This report contains an overview of selected effects of the 1992 Texas closure and will be presented to the Gulf of Mexico Fishery Management Council in January 1993.

## Background

The Shrimp FMP regulates fishing for brown shrimp in the Exclusive Economic Zone (EEZ) off the coast of Texas. This regulation prohibited brown shrimp fishing in the total EEZ (200 mile closure) during the periods: May 22-July 15, 1981; May 26-July 14, 1982; May 27-July 15, 1983; May 16-July 6, 1984; and May 20-July 8, 1985. In 1986, 1987 and 1988, only the portion of the EEZ from 9 to 15 miles was closed to fishing. In 1986, the area was closed May 10-July 2, while in both 1987 and 1988, the Texas offshore waters were closed from June 1-July 15. In 1989, the 200 mile closure again went into effect and has remained in effect every year since that time. Closure periods were June 1-July 15, 1989; May 15-July 8, 1990; May 17-July 6, 1991; and May 15-July 6, 1992. State of Texas regulations, implemented in 1960, prohibited shrimp fishing in the territorial sea off Texas during these same periods, except for the white shrimp fishery from the beach to the 4 fathom depth line. In 1990, however, state law prohibited all shrimping activities including the 4 fathoms daytime fishery. This same law was in effect during both the 1991 and 1992 closures.

The management objectives of the Texas closure regulation (as specified in the FMP) are to increase the yield of brown shrimp and eliminate the waste of the resource caused by discarding undersized shrimp caught during a period in their life cycle when they are growing rapidly. The objective of the 1960-1980 Texas territorial sea closure was to manage the fishery so that a substantial portion ( $\geq 50\%$ ) of the shrimp in Gulf waters had reached 65 tails/pound or 112 mm in length by the season's opening. Thus, the temporary closure of the offshore fishery from mid-

May to mid-July each year provides larger shrimp to the fishery and subsequently a higher market value.

## Methods

Port agents collected statistics on the catch, effort, and fishing location of shrimp vessels operating in the Gulf of Mexico. These data provided information on the species, size and location of shrimp, as well as information on the catch rates and fishing efforts of the vessels in the fleet.

## Conclusions

### 1. Recruitment

Initial estimates of recruitment of brown shrimp to Texas offshore waters in 1992 appeared to be lower than in most years. We predicted the 1992 annual (June 1992-May 1993) offshore harvest to range between 18.6 and 24.1 million pounds, which is below the average (1960-1990) production of 27.2 million pounds. The offshore catch from June-August 1992 was 10.7 million pounds, which projected for the year June 1992-May 1993 amounts to about 21.4 million pounds. This value is within our predicted range.

A wide array of environmental and biological factors may have affected recruitment and survival of postlarval brown shrimp entering Texas and western Louisiana estuaries this year. Texas rainfall amounts in 1992, as in 1990 and 1991, were well above the historical average, resulting in low salinities in estuarine marsh habitats. Louisiana had near normal rainfall amounts this past season. In Texas the combination of excessive rainfall and cooler temperatures may have reduced available nursery habitat and slowed or inhibited growth. This is evident from our 1992 postlarval and juvenile abundance indices as well as the below-average sized shrimp observed in the landings. The reduced nursery habitat most likely concentrated shrimp in smaller areas, thus reducing food availability and increasing predation.

Prospects for Louisiana brown shrimp harvests were higher; our model for waters west of the Mississippi River suggested inshore and offshore catches (May



1992-April 1993) should be about  $26.3 \pm 12.0$  million pounds, which is 2.4 million pounds below the 28.7 million pounds average annual yield for the area (1960-1990). Louisiana Wildlife and Fisheries scientists estimated that 1.6 million acres of prime nursery habitat for brown shrimp were available in 1992. Despite the increase in habitat over last years value of 1.0 million acres, other environmental conditions were apparently below average for shrimp growth and survival. The catch from May-August 1992 was 23.0 million pounds, which projects an annual yield from May 1992-April 1993 of 28.7 million pounds. This value is within our predicted range.

Thus, the western Gulf of Mexico should experience a combined annual brown shrimp production level of between 44.9 million pounds (18.6 million + 26.3 million) and 55.4 million pounds (24.1 million + 26.3 million) during the 1992-1993 season, which is below the 55.9 million pounds average for the area.

## 2. Fishing Trends

### Louisiana

The May through August 1992 catch in Louisiana for inshore waters amounted to 11.6 million pounds, with 91% of the total catch in May and June. This year's inshore production was average for the May through August period (Table 1).

In 1992, May inshore production was 4.2 million pounds with June production at 6.3 million pounds. Catch levels dropped quickly after June, with a July catch of only 0.7 million pounds and an August catch of 0.4 million pounds.

In May 1992, the Louisiana offshore fishery produced only 1.4 million pounds of brown shrimp, with 6,900 days of fishing effort, for an average CPUE value of only 209 pounds per day. Similar to most years the majority of the catch occurred in the shallow waters of statistical subareas 13-15 (Figure 1). CPUE values were low in all subareas (200 - 300 pounds per day), but highest in subareas 13 and 14.

In June, the fishery off Louisiana produced 3.6 million pounds of brown shrimp with a fishing effort of over 15,300 days. The average CPUE value was 234 pounds per day. CPUE values were low (200 - 300 pounds per day) in most statistical subareas (Figure 2). When compared to May, production took place further offshore in each of the five statistical subareas (13-17).

In July, the offshore fishery in statistical subareas 13-17 produced 3.8 million pounds of brown shrimp with an effort of about 7,000 days of fishing (Table 2). Average CPUE was 535 pounds per day. CPUE values were lowest in subareas 13 and 14, moderate in subareas 16 and 17, and highest in subarea 15 (Texas subareas not included in this discussion) (Figure 3). Most of the catch was in water shallower than 10 fm in all statistical subareas.

In August, the Louisiana offshore fishery produced approximately 2.6 million pounds of brown shrimp with an effort value of 5,200 days. Average CPUE was only 497 pounds per day. Catch levels were moderate in all statistical subareas (Figure 4).

Thus, during the May-August 1992 period, 11.4 million pounds of brown shrimp were landed from the offshore Louisiana fishery. This catch level is high when compared to most other values since 1981 (Table 1). This catch came from a high expenditure of effort. A total of nearly 34,400 days of fishing occurred during this four month period off Louisiana. Average CPUE was 331 pounds per day.

## Texas

Thus far in biological year 1992, 4.3 million pounds of brown shrimp have been landed from Texas bays (Table 1). This is the third lowest catch ever recorded from Texas inshore waters since the closure began in 1981. Monthly catches during 1992 were greatest in May and June with 1.4 million pounds in May and 2.2 million pounds in June. These two months accounted for 84% of the catch during the four month period. Landings in July were 0.7 million pounds landed, and dropped off quickly in August with about 13 thousand pounds landed.

The 1992 offshore production from May through August amounted to 11.2 million pounds with 10.4 million pounds (95%) of the catch produced in the July

through August period (Table 1). The four month catch total experienced this year was the second worst since closures began in 1981; only the record low catch noted in 1983 was lower (10.7 million pounds) (Table 1).

In May 1992, a little over 0.5 million pounds of brown shrimp were landed with an effort of around 1,700 days fished. This produced a CPUE value of 309 pounds per day. Catch increased in magnitude as one moved from north areas (subarea 18) to south areas (subarea 21). Subarea 21 had the greatest catch CPUE values (Figure 1).

With the entire EEZ closed to shrimp trawling, June production was only 50 thousand pounds. This value is similar to most other June levels during 200 mile closure years, but reduced below catches experienced during 15 mile closure June periods. Effort could not be calculated for the area. Average CPUE was not estimated since effort could not be calculated. Catch was low in all statistical subareas (18-21) (Figure 2).

Total catch in July was 6.4 million pounds with only 8,700 days fished. This is a below average catch for the month of July, even through effort levels were moderate (Tables 1 and 2). CPUE during the July period was 728 pounds per day (Table 2). This is the first time the July CPUE value has been below 1000 pounds per day following a 200 mile closure. CPUE was highest in subareas 18 and 21 (Figure 3). The greatest catch occurred in the 16-20 fm depth off statistical subareas 18-19, and in the 11-15 fm depth off subarea 21 (Figure 3).

In August, the offshore Texas catch was 4.3 million pounds of brown shrimp with an effort of about 8,600 days of fishing. CPUE was around 499 pounds per day. Catch was low, but effort values were high when compared to other August values. Thus, CPUE was at the low end of the range when compared to other August values (Table 2). As in years past, most production was concentrated in subareas 18 and 19 (Figure 4), but all subareas off Texas experienced moderate CPUE values, with subarea 18 having the best at around 558 pounds per day (Figure 4).

### 3. Distribution of Catch From Texas Waters



Some concern has been expressed that the distribution of landings following the Texas closure has changed in recent years. To evaluate this problem the Texas catch (all shrimp species) during the May through August period, was partitioned by port of landing. Landing locations were summarized into five general groups. These groups included lower Texas ports (Port Mansfield, Aransas County, Riviera, Nueces County, Port Isabel and Brownsville), middle Texas ports (Brazoria County, Matagorda County, Calhoun County, Refugio County, Port Lavaca, Matagorda, Palacios, Port O'Connor and Seadrift), upper Texas ports (Jefferson County, Chambers County, Galveston Island, Harris County and Kemah), Louisiana ports (all Louisiana ports), and other ports (ports from Mississippi, Alabama, Florida and the U.S. east coast).

The shrimp catch from Texas waters (Figure 5) and its distribution to various ports throughout the Gulf of Mexico has not significantly changed since 1977 (Figure 6). Lower Texas ports seem to have the greatest percentage of the landing at around 48%. This is followed by the middle Texas ports (29%) and then the upper Texas ports (17%). This relationship seems to maintain itself during both 15 mile (1986-1988) and 200 mile closure years (1981-1985, 1989-1992). Overall, about 94% of the catch from Texas waters is landed in Texas ports.

#### 4. Shrimp Landings by Port

The distribution of shrimp landings in Texas ports was examined to determine if changes had occurred since the initial closure in 1981. May through August Gulf-wide shrimp catch was summarized by port of landing. During the May through August period about 35% of the shrimp caught in the U.S. Gulf of Mexico is landed in Texas ports. This distribution has not changed to any great extent during the 12 year closure period under consideration (high in 1991 of 43.7%, low in 1986 of 30.1%) (Figure 7).

Distribution of Texas landings by individual ports was examined next. Figure 8 contains the landings for the five upper Texas coast ports, Figure 9 contains the landings for the five middle Texas coast ports, while Figure 10 contains the landings for the four lower Texas coast ports. The five upper Texas coast ports (with overall mean catch percentage) included Jefferson (9.0%), Chambers (1.0%), Galveston (3.1%), Harris (2.2%), and Kemah (7.5%). The five middle Texas coast ports (with

overall mean catch percentage) included Port Lavaca (5.4%), Brazoria (9.5%), Matagorda (1.1%), Palacios (7.5%), and Seadrift (3.0%). The four lower Texas coast ports (with overall mean catch percentage) included Aransas (18.7%), Nueces (5.3%), Port Isabel (12.7%), and Brownsville (12.9%). Of the seven higher percentage ports, Aransas, Brownsville and Port Isabel have historically averaged the greatest landings and have not changed significantly when landings during 200 mile and 15 mile year are compared. All three showed a decrease in 1992 when compared to the 1991 value. Brazoria percentage decreased in 1983 from 15.1% to 8.2% and has since remained near that level. The port had an increase in 1992 when compared to the 1991 level. Jefferson and Palacios have both shown increased landing percentages through the period, with Jefferson raising at a slightly faster rate than Palacios. Both ports showed increases in 1992 when compared to the 1991 value.

Many of the small percentage landing ports have shown changes during the twelve year period. Nueces had the highest landing percent during the early 1980's (6.5%), but the percentage dropped in 1988 to 2.7%. The landing percentage rose in 1990 to 4.7% and has since been at that level. No significant difference in landings during 200 mile and 15 mile year were found during analysis. Chambers landings averaged 1.3% of the total before 1989. Levels dropped in 1989 and again in 1990 to a percentage of about 0.3%, and have remained low since that time. This port was the one with the least percentage of the landings during 1992. There is a significant difference when landings during 200 mile and 15 mile year are compared for this port. However, it should be noted that the difference may be from a recent change, since the landings from the early 200 mile closure years are comparable to landings during 1986 and 1989. Galveston, Seadrift and Matagorda landing percentages have not shown any major increases or decreases during the period. Landing percentages in Port Lavaca increased until about 1988 (9.0%) and then decreased in 1989 (5.4%). Levels have remained about the same since that time. There is a significant difference when landings during 200 mile and 15 mile year are compared for this port. Harris landing percentages increased until 1987 (2.9%) and then decreased in 1989 (1.6%) and 1990 (1.3%), but increased again in 1991 (1.9%) and 1992 (4.0%).

## 5. White Shrimp Catch off Texas



For the third consecutive year the 0-4 fathom white shrimp fishery off Texas has been closed in conjunction with the Texas closure. During July 1990, following the first white shrimp closure, the majority of the white shrimp were in the <15 count range (Figure 11). This large shrimp trend carried into August 1990, with the majority of the shrimp in the <30 count group (Figure 12). Following the 1991 closure the majority of the shrimp in July were in the <20 count range, with a peak in production that had not been experienced in any other year since 1960. The 1.0 million pounds of white shrimp taken in July off Texas was about 2 times greater than any previous recorded catch. The abundance of shrimp in August 1991 was still good, but production values during 1984, 1986 and 1990 were better (Figure 12). The white shrimp in August 1991 were still quite large, with the majority <25 count.

Following the 1992 closure, the majority of the shrimp in July were again in the <20 count range, with a peak in production second only to the level experienced in 1991. The abundance of shrimp in August 1992 was quite high, but unlike the last two years the majority of the catch was composed of small sized shrimp (>41 count).

## 6. Brown Shrimp Migration Studies

Many brown shrimp mark-recapture research efforts have been conducted in the northwestern Gulf of Mexico to study migration patterns. Below is a summary of these studies, with general brown shrimp movement patterns and distances traveled noted for most. The general trends in each of the papers show that small brown shrimp travel out of the bays in May and June into deeper water and then spread out parallel to the shore. Tagged brown shrimp were usually recaptured very close to the release sites, usually within 20 to 30 nm. Direction vectors were calculated for the recaptured shrimp, but as noted above the recaptures occur close to the release site. It should be remembered that these direction vectors can be heavily influenced by a very few shrimp which travel above average distance away from the release site.

**Klima E. F. 1963. Mark-recapture experiments with brown and white shrimp in the northern Gulf of Mexico. Proceedings of the Gulf and**

**Caribbean Fisheries Institute, Sixteenth Annual Session, November 1963, p. 52-64.**

A total of 2,431 stained brown shrimp was released in a 100 square mile area south of Pass Cavallo, Texas, (statistical area 19) in water which ranged from 21 to 24 fm in depth. Two groups (976 and 716) of tagged brown shrimp were released on each side of the stained group (statistical areas 18 and 20). Of the stained shrimp released, 153 (6%) were recovered, while 87 (5%) of the tagged shrimp were recovered. Data indicated minimal offshore movement. Most (90%) of the recaptured shrimp were taken within 30 miles of their release site. The longest movement was about 70 miles. Movement by most shrimp was parallel to the coast in both directions from the release sites.

Stain-marked brown shrimp were released in offshore waters near Grand Isle, Louisiana, (2,274) and Galveston, Texas, (2,973) in July 1962. More than 98% of the shrimp recovered from the Louisiana experiment were recaptured within 30 miles of the release areas, the remaining 2% having moved less than 60 miles. Movements were seaward and generally to the west. Over 88% of the marked shrimp recovered from the Texas experiment were caught within 30 miles of the area of release, while 6% had traveled more than 60 miles in a southwesterly direction.

**Clark, S. H., D. A. Emiliani, and R. A. Neal. 1974. Release and recovery data from brown and white shrimp mark-recapture studies in the northern Gulf of Mexico, May 1967 - November 1969. NMFS Data Report, NMFS-DR-85.**

During seven mark-recapture studies conducted in the northern Gulf of Mexico during the period May 1967 to November 1969, a total of 75,947 brown shrimp were marked and released. A total of 6,192 (8%) brown shrimp were recovered. Data was not analyzed to give direction of movement or distance traveled after release.

**Welker, B. D., S. H. Clark, C. T. Fontaine and R. C. Benton. 1975. A comparison of Petersen tags and biological stains used with internal tags as marks for shrimp. Gulf Research Report 5(1): 1-5.**

During May 1969, 14,301 brown shrimp were caught, tagged and released in Biloxi Bay, MS. Eighteen weeks later 4,228 (30%) tagged shrimp had been recovered. Most (3,351) were taken in Biloxi Bay and had traveled only a few nautical miles from the release site. The few captures outside the Bay suggested that the shrimp moved to the south, spreading out to the east and west as they traveled.

**Hollaway, S. L. and L. F. Sullivan. 1979. Penaeid shrimp tagging experiments in Louisiana, 1979. NOAA Technical Memorandum, NMFS-SEFC-89.**

A total of 55,183 tagged brown and white shrimp were released at inshore and offshore Louisiana locations in 1979. There were eight offshore release locations and two inshore release locations (Caillou Lake and Barataria Bay). With regards to the recaptured inshore-tagged shrimp, 77% were recovered from inshore waters very close to release sites. The remaining 23% were recaptured in offshore areas generally west to southwest of the release areas at a distance of less than 30 nm. Most shrimp released offshore were recaptured at a distance of about 30 nm southeast to southwest of the release sites.

**Cody, T. J. and R. M. Avent. 1980. Mark-recapture studies of penaeid shrimp in Texas, 1978-1979. TPWD Data Management Ser. 14, 64 p.**

From May 1978 through October 1979, 10 mark-recapture studies were conducted and 77,843 shrimp were released in either inshore or offshore areas near Port Aransas, Port Mansfield or Port Isabel, Texas. A total of 559 were recaptured. The recapture rates for inshore studies were <2.2%, while those for offshore studies were between 6.7 - 10.0%. Most of the recovered shrimp had moved <37 km (20 nm). Short-term recoveries came from all directions, with dominant movement along-shore to the northeast and south. The few long-term recaptures from the offshore studies came from the south.

**Hollaway, S. L. and K. N. Baxter. 1981. A summary of results of Louisiana brown shrimp tagging experiments, 1978. NOAA Technical Memorandum, NMFS-SEFC-78.**



Inshore tagging efforts were concentrated in the Caillou Lake estuarine system during May (16,726), June (15,716) and July (5,936); inshore total was 38,378 shrimp. Offshore tagging studies were carried out southwest of Caillou Lake and south of Calcasieu Lake in June (7,457 and 3,699 respectively), and south of Calcasieu Lake in July (868) and August (1,521); offshore total was 13,545 shrimp. Of the 51,923 tagged brown shrimp released, a total of 4,138 (8%) were recaptured. Analysis showed that the majority (86%) of the shrimp released in the inshore areas traveled in a south to southwest direction less than 10 nm. Most were recaptured within 50 - 60 days of release. Analysis showed that the majority (59%) of the shrimp released in offshore areas traveled in a south direction, while 20% traveled to the southeast and southwest of the release site. Most were recaptured within 40 - 50 days of release and had traveled less than 30 nm.

**Gazey, W J., B. J. Gallaway, R. C. Fechhelm, L. R. Martin, and L. A. Reitsema. 1982a. Shrimp mark-release and port interview sampling survey of shrimp catch and effort with recovery of recaptured tagged shrimp. Vol. III. In: Jackson, W. B. (ed.), Shrimp population studies: West Hackberry and Big Hill brine disposal sites off southwest Louisiana and upper Texas coasts, 1980-1982. NOAA/NMFS Final Report to DOE.**

From May through August 1981 a total of 68,715 brown shrimp were tagged and released (30,348 inshore and 38,367 offshore). Inshore sites included east Galveston Bay, Texas (15,373), and Calcasieu Lake, Louisiana (14,973). Offshore sites included the Big Hill diffuser site off Texas, and the West Hackberry diffuser site off Louisiana. This data was combined with the earlier Texas and Louisiana (1977-1980) mark-recapture data for analysis. Orientation statistics from the study are presented in Table 3 of this report. All cohorts had orientations significantly ( $P < 0.05$ ) different than random. During the 1978 releases most of the tagged shrimp moved in a southwest direction and were recaptured less than 20 km from the release site. In 1979 the same west to southwest movement was noted, again with less than 20 km traveled. In the 1980 release off the east side of the Mississippi River the tagged brown shrimp moved about 7.5 km in a east southeast direction. During 1981 the movement of the brown shrimp was to the south and southwest from the release sites.

**Gazey, W J., B. J. Gallaway, R. C. Fechhelm, L. R. Martin, L. A. Reitsema, K. F. Benney, R. Schroeder and D. Chester. 1982b. Shrimp mark-release and port interview sampling survey of shrimp catch and effort with recovery of recaptured tagged shrimp. Vol. I. In: Jackson, W. B. (ed.), Shrimp population studies: Bryan Mound brine disposal site off Freeport, Texas, 1981-1982. NOAA/NMFS Final Report to DOE.**

From June through October 1981 a total of 44,645 brown shrimp were tagged and released. Orientation statistics from the study are presented in Table 4 of this report. All cohorts had orientations significantly ( $P < 0.05$ ) different than random. During the 1978 releases off Corpus Christi, Texas, the tagged shrimp moved to the east (deeper water) and south along the coast. Average distance traveled was 15 km. During 1979 the tagged shrimp moved generally in a south to southeast direction, with the average distance traveled in the range for 10 to 30 km. In 1980, movement was to the south and southwest of the release sites, with most travel distances less than 25 km. At one site the shrimp moved an average of 12.8 km to the east northeast. During 1981 the brown shrimp moved generally in a south direction, with some moving to the southeast or southwest of the release sites. Most distance traveled were less than 20 km.

**Savoie B. and R. Ancelet. 1987. Louisiana/Mississippi cooperative shrimp mark-recapture project. MARFIN Program Final Report. Contract Number NA86WC-H-06127.**

In May and June 1987, 16,000 tagged brown shrimp were released into Louisiana estuarine marsh systems east of the Mississippi River. All release sites were located in Coastal Study Areas I and II (CSA I and CSA II). Of the four release sites located in CSA I, three are located on the western edge of Lake Borgne between Bayou Bienvenue and Bayou Thomas. The fourth release site is located at the intersection of the Intracoastal Waterway and the Mississippi River Gulf Outlet. Two release sites were in CSA II. One is located at River aux Chenes and Bayou la Croix. The second is at Bayou Lost on Bay Gardene, near Breton Sound. Of the 8,000 tagged shrimp released in CSA I, a total of 248 (3.1%) shrimp returns were reported. None of the tagged shrimp returned indicated any substantial movement and most (96%) were recaptured within 10 miles of the release site. Of the 8,000 shrimp tagged in CSA II, a total of 175 (2.2%) shrimp returns were reported. Most



(76%) of the shrimp were recaptured within 2 miles of the release site. Twenty-two (21%) of the tagged shrimp indicated movement toward Breton Sound and the Gulf. Little knowledge about migration of brown shrimp in offshore waters is found in this study.

**Sheridan, P. F., F. J. Patella, Jr., N. Baxter, and D. A. Emiliani. 1987. Movements of brown shrimp, *Penaeus aztecus*, and pink shrimp *P. duorarum*, relative to the U.S. - Mexican border in the western Gulf of Mexico. Marine Fisheries Review 49 (1):14-19.**

Seasonal movement patterns of marked brown shrimp relative to the Texas-Mexico border are described using the recaptures of shrimp tagged during 1978 - 1980. The intent was to determine the degree to which coastal shrimp movements would affect commercial catches after implementation of new fishing regulations off Texas and Mexico. Movements of shrimp were examined by vector analysis. Offshore release of 71,485 brown shrimp from 30 release sites (dates) resulted in a 12.4% recapture rate. Analysis of brown shrimp movements from each of the 30 release sites showed that the released shrimp had significant south movement in 16 cases, significant north movement in 3 cases and no significant movement to either the north or south in 11 cases. About 70% of the tagged brown shrimp were returned within 30 days of release. Average distance traveled was not discussed in this paper.

**Savoie B. and R. Ancelet. 1988. Louisiana shrimp mark-recapture project. MARFIN Program Final Report. Contract Number NA87WC-H-06123.**

In May and June 1988, 10,000 tagged brown shrimp were released into Louisiana estuarine marsh systems east of the Mississippi River. All release sites were located in Coastal Study Areas I and II (CSA I and CSA II). Of the four release sites located in CSA I, three are located on the western edge of Lake Borgne between Bayou Bienvenue and Bayou Thomas. The fourth release site is located at the intersection of the Intracoastal Waterway and the Mississippi River Gulf Outlet. Two release sites were in CSA II. One is located at Petit Lake, a small lake south of the town of Delacroix. The second is at Grand Lake, a small lake to the west of the first release site, Petit Lake. Of the 6,000 tagged shrimp released in CSA I, a total of 79 (1.3%) shrimp returns were reported. None of the tagged shrimp returned indicated any substantial movement. Most (71%) were recaptured within 2.0 miles



of the release site. Of the 4,000 shrimp tagged in CSA II no tagged shrimp returns were reported. Little knowledge about migration of brown shrimp in offshore waters is found in this study.

**Sheridan, P. F., R. G. Casto M., F. J. Patella, Jr., and G. Zamora, Jr. 1989. Factors influencing recapture patterns of tagged penaeid shrimp in the western Gulf of Mexico. Fishery Bulletin 87:295-311.**

Transboundry research along the Texas-Mexico border was conducted during the summer of 1986. Between May 30 and July 11, 1986, 24,996 brown shrimp were tagged and released. There was a recapture rate of about 13.4%. Brown shrimp moved an average distance of 25 km off Tamaulipas and 12 km off Texas. Recaptures were standardized by fishing effort. Standardized values (recaptures per effort) north or south of release sites indicated no significant differences in brown shrimp movements off Texas or Tamaulipas.

Table 1. May - August catch of brown shrimp in millions of pounds from Louisiana (13-17) and Texas (18-21)

Area	1992	1991	1990	1989	1988	1987	1986	1985	1984	1983	1982	1981
<b>Louisiana</b>												
Inshore	11.6	6.5	15.9	11.3	14.0	12.4	14.3	8.9	14.9	12.1	15.1	15.2
Offshore	11.4	20.6	24.9	20.5	14.9	20.8	22.8	16.4	13.6	8.8	13.7	23.1
Total	23.0	27.1	40.8	31.0	28.9	33.2	37.1	25.7	28.5	20.9	28.8	38.3
<b>Texas</b>												
Inshore	4.3	7.8	7.4	6.1	6.9	7.6	5.1	5.4	7.1	5.9	4.1	4.2
Offshore	11.2	21.3	20.4	17.3	15.2	17.5	14.0	14.5	16.1	10.7	13.9	25.3
Total	15.5	29.1	27.8	23.4	22.1	25.1	19.1	19.9	23.5	16.4	18.0	29.5
<b>Offshore Only</b>												
<b>Louisiana</b>												
May-June	5	15.5	18.8	13.0	6.6	11.5	13.2	10.9	7.1	3.9	8.6	12.6
July	3.8	3.2	4.5	4.9	4.1	6.0	6.3	3.0	3.8	2.6	3.3	7.5
August	2.6	1.9	1.6	2.6	4.2	3.3	3.3	2.5	2.7	2.3	1.8	3.0
<b>Texas</b>												
May-June	0.5	1.2	0.8	1.0	2.7	3.3	3.3	0.6	0.8	0.7	0.8	0.4
July	6.4	12.7	11.9	7.3	7.5	8.9	5.7	8.3	8.8	5.2	6.6	10.4
August	4.3	7.4	7.7	9.0	5.0	5.3	5.0	5.6	6.5	4.8	6.5	14.5

Table 2. Summary of Offshore Fishing Effort and CPUE for Louisiana (13-17) and Texas (18-21)

	Fishing Effort (1000 Days)					
	Area 13 - 17			Area 18 - 21		
	May - June	July	August	May - June	July	August
1981	14.8	8.1	3.8	1.1	4.4	10.4
1982	14.2	6.4	3.4	2.6	5.2	10.2
1983	9.1	4.2	4.9	2.3	3.7	6.7
1984	9.8	6.4	4.7	2.4	8.2	9.0
1985	11.1	6.0	3.7	1.5	6.8	8.4
1986	15.9	7.5	4.3	6.3	6.3	6.2
1987	19.0	10.0	5.8	7.7	9.8	8.2
1988	18.8	7.5	8.0	7.1	9.6	8.7
1989	28.5	8.2	2.8	3.8	5.7	10.2
1990	25.3	9.3	3.0	2.8	8.3	8.2
1991	34.7	4.1	3.9	2.5	8.2	7.6
1992	22.2	7.0	5.2	1.7	8.7	8.6

	CPUE (Pounds per Fishing Day)					
	Area 13 - 17			Area 18 - 21		
	May - June	July	August	May - June	July	August
1981	852	927	799	308	2,382	1,408
1982	607	525	522	295	1,279	629
1983	430	415	470	310	1,414	714
1984	718	598	573	295	1,074	723
1985	982	612	682	389	1,223	672
1986	830	840	773	524	896	799
1987	605	595	577	429	905	653
1988	351	556	521	538	781	578
1989	454	603	832	273	1,276	889
1990	749	473	517	298	1,426	937
1991	448	752	496	483	1,554	971
1992	226	535	497	343	728	499



**Table 3. Migration orientation statistics for brown shrimp by cohorts for West Hackberry Study (from Gazey et al. 1982a)**

<b>Year</b>	<b>Release Location</b>	<b>Date</b>	<b>Observations</b>	<b>Compass Heading</b>
<b>1978</b>	Caillou Lake	May 16 - May 31	1365	219.4
	Caillou Lake	Jun 12 - Jun 28	1487	225.4
	Caillou Lake	Jul 11 - Jul 19	389	248.6
	Offshore (Below Marsh Island)	Jun 10 - Jun 14	104	288.6
	Offshore (West Hackberry)	Jun 16 - Jun 19	282	180.9
	Offshore (Off West Hackberry)	Aug 05 - Aug 08	38	238.2
<b>1979</b>	Barataria Pass	Apr 23 - May 09	89	260.7
	Barataria Pass & Caillou Lake	Jun 11 - Jun 20	431	263.4
	Barataria Pass & Caillou Lake	Jul 09 - Jul 20	305	245.3
	Caillou Lake	Aug 13 - Aug 16	83	208.6
<b>1980</b>	Offshore (East of Mississippi R.)	Sep 17 - Sep 29	392	117.0
<b>1981</b>	Calcasieu Lake	May 12 - Jun 10	1007	186.1
	Offshore (West Hackberry)	Jun 27 - Jun 27	58	218.8
	Offshore (Big Hill)	Jul 11 - Jul 30	93	224.9
	Offshore (Big Hill)	Aug 9 - Aug 14	40	227.3

**Table 4. Migration orientation statistics for brown shrimp by cohort for the Bryan Mound Study (from Gazey et al. 1982b)**

<b>Year</b>	<b>Release Location</b>	<b>Date</b>	<b>Observations</b>	<b>Compass Heading</b>
1978	Offshore (East of Corpus Christi)	Aug 9 - Aug 18	164	91.1
	Offshore (East of Corpus Christi)	Oct 12 - Oct 20	128	185.7
1979	Port Isabel	Apr 23 - May 01	77	166.3
	Offshore (North of Port Isabel)	May 22 - May 29	316	135.7
	Offshore (South of Matagorda)	Sep 21 - Oct 03	393	173.1
	Bryan Mound	Sep 08 - Oct 03	121	196.9
	Bryan Mound	Oct 13 - Oct 20	738	194.2
	Bryan Mound	Nov 27 - Nov 27	96	148.5
1980	Port Isabel	Apr 16 - Apr 22	223	207.1
	Offshore (North of Port Isabel)	May 18 - Jun 02	118	63.7
	Offshore (East of Corpus Christi)	Jun 19 - Jun 26	54	141.8
	Bryan Mound	Jun 17 - Jun 27	661	229.1
	Offshore (East of Corpus Christi)	Jul 16 - Jul 25	214	179.4
	Bryan Mound	Jul 22 - Jul 29	600	223.0
1981	East Galveston Bay	May 21 - Jun 27	641	241.8
	Bryan Mound	Jun 17 - Jun 23	423	166.9
	Bryan Mound	Jul 07 - Jul 07	24	135.2
	Bryan Mound	Jul 13 - Jul 15	639	148.7
	Bryan Mound	Aug 05 - Aug 11	1436	183.1
	Bryan Mound	Sep 16 - Oct 08	1642	193.3
	Off Galveston Jetty	May 29 - Jun 02	26	221.1
	Offshore (East of Freeport)	Jul 10 - Jul 12	1099	275.6

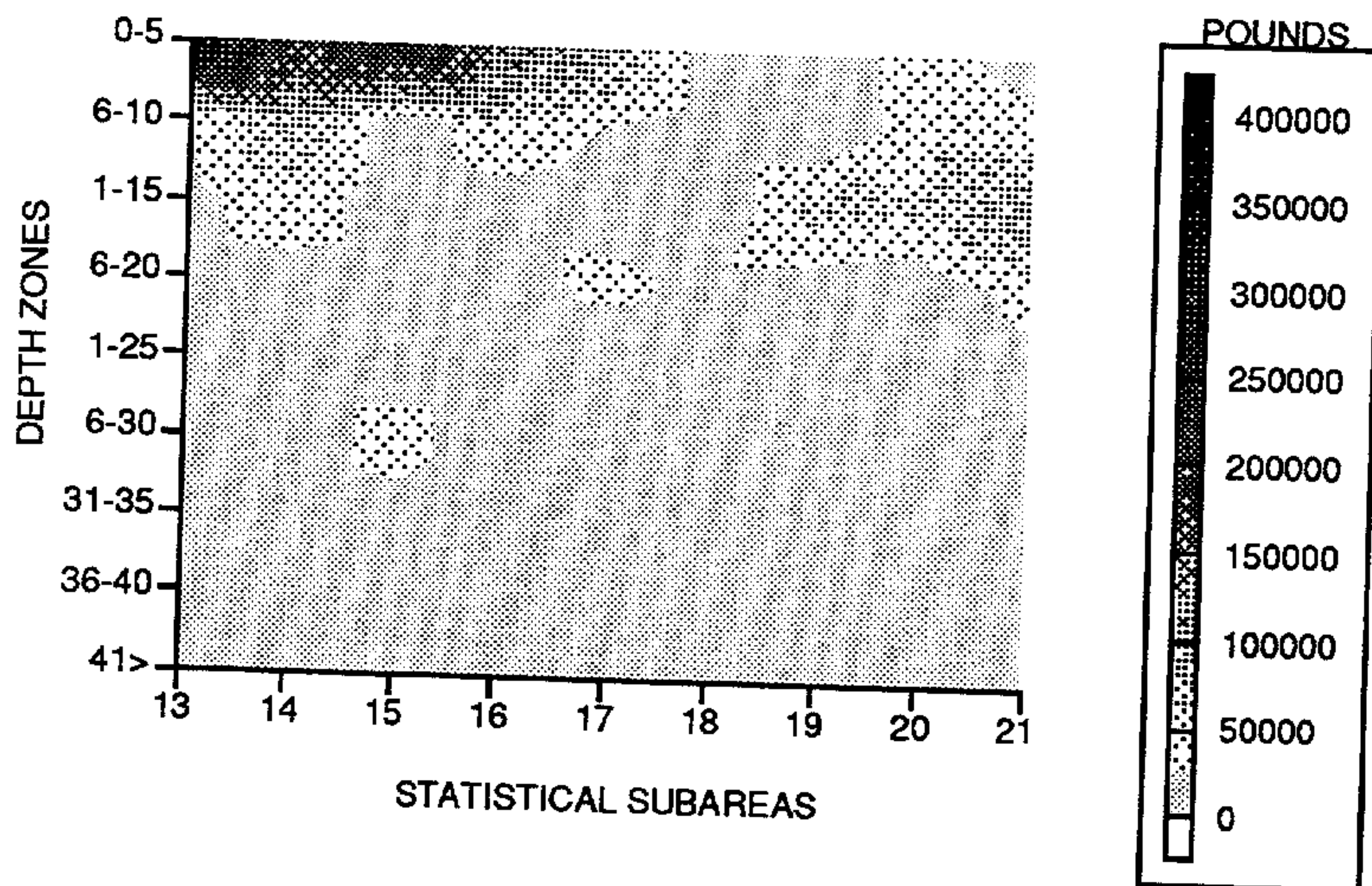
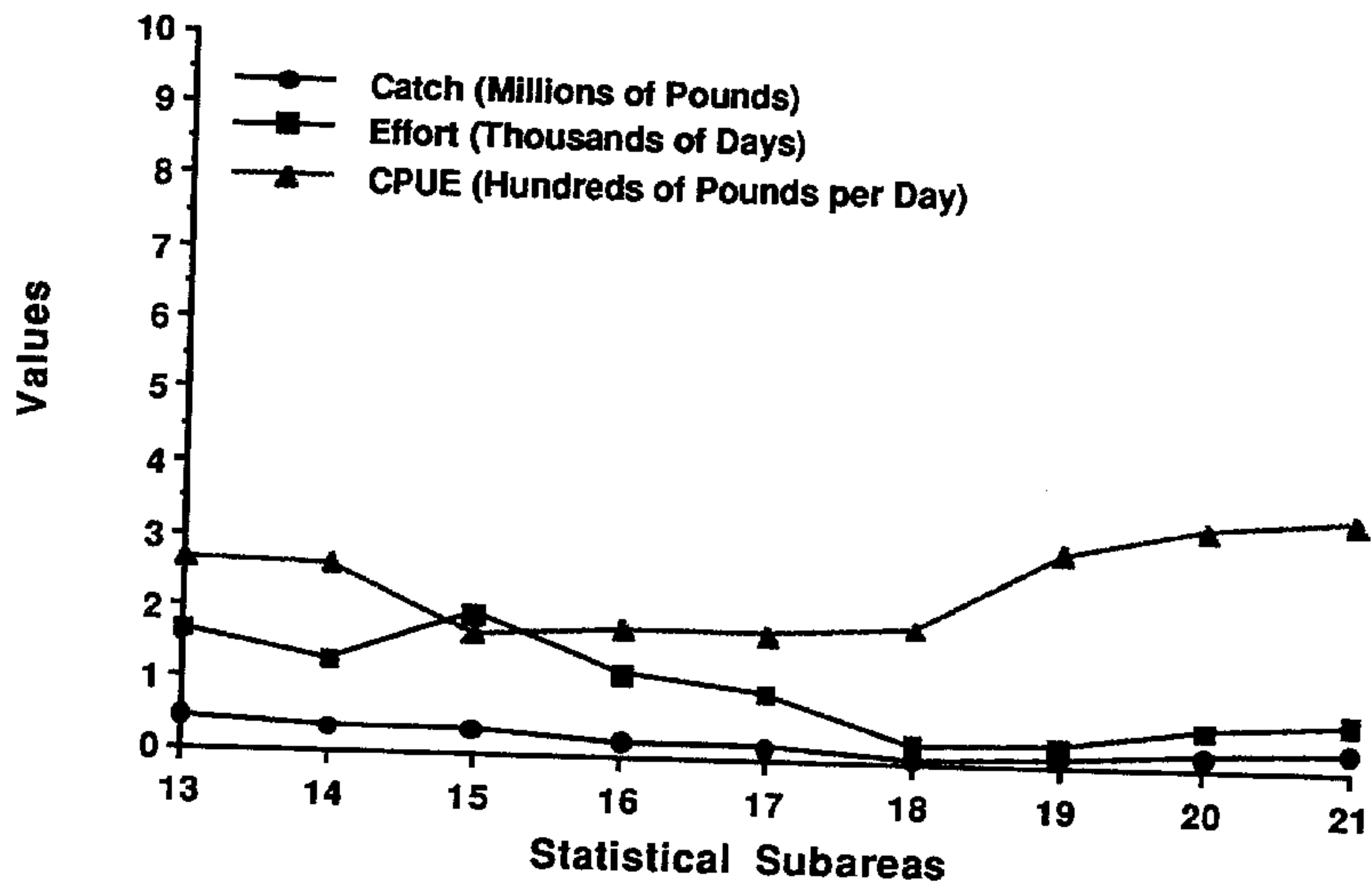


Figure 1. Offshore brown shrimp catch, effort and CPUE values during May 1992.



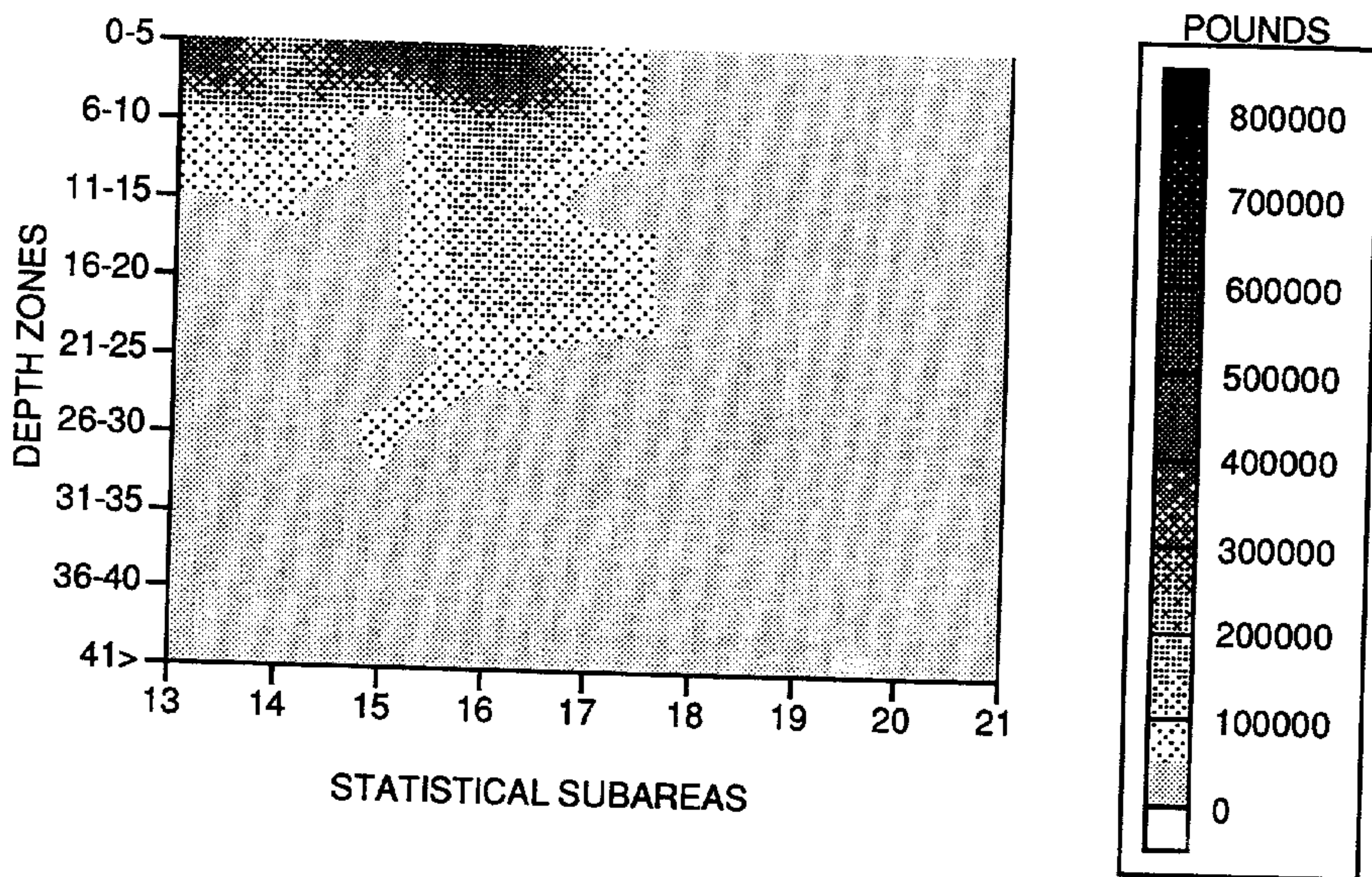
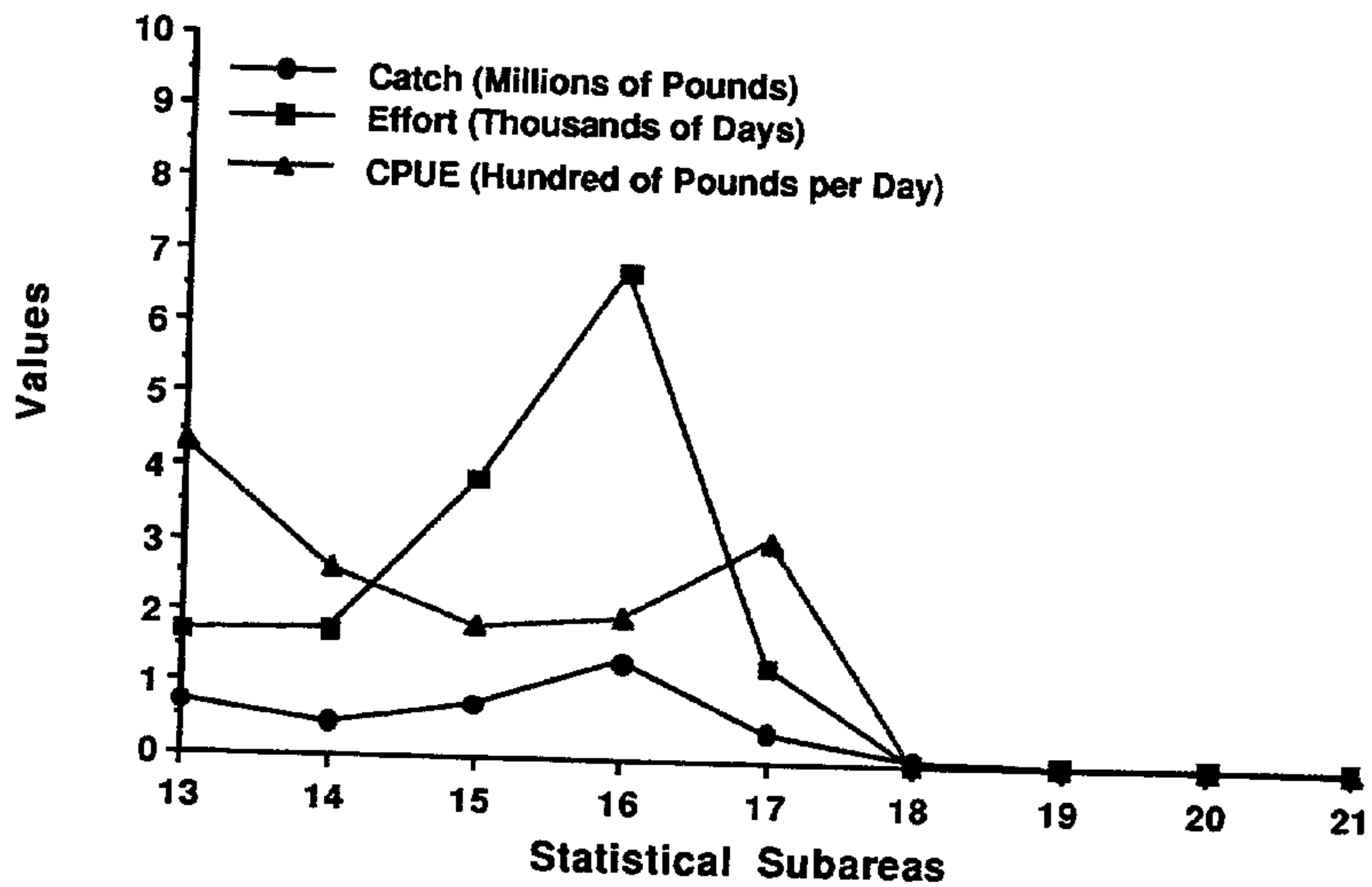


Figure 2. Offshore brown shrimp catch, effort and CPUE values during June 1992.

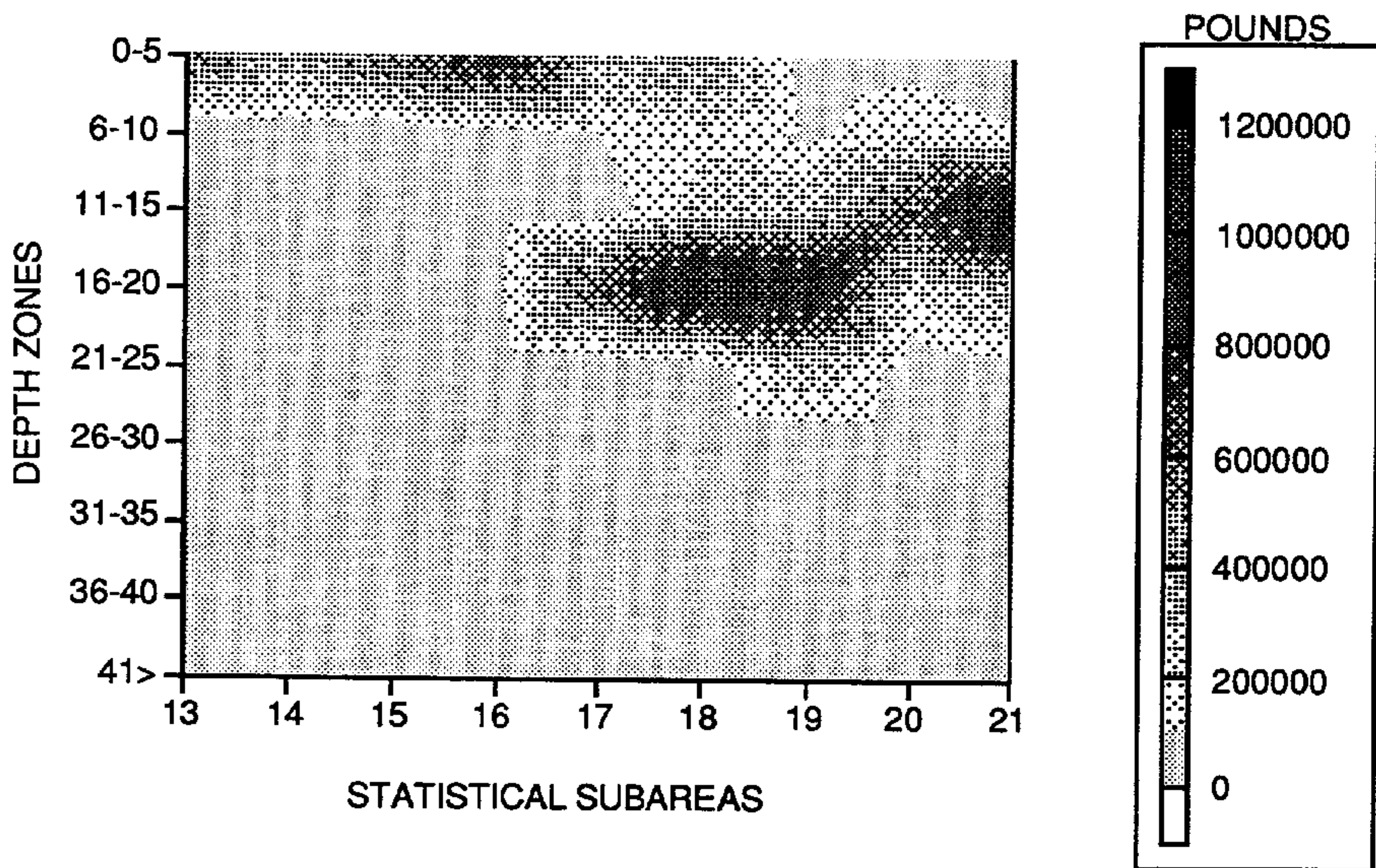
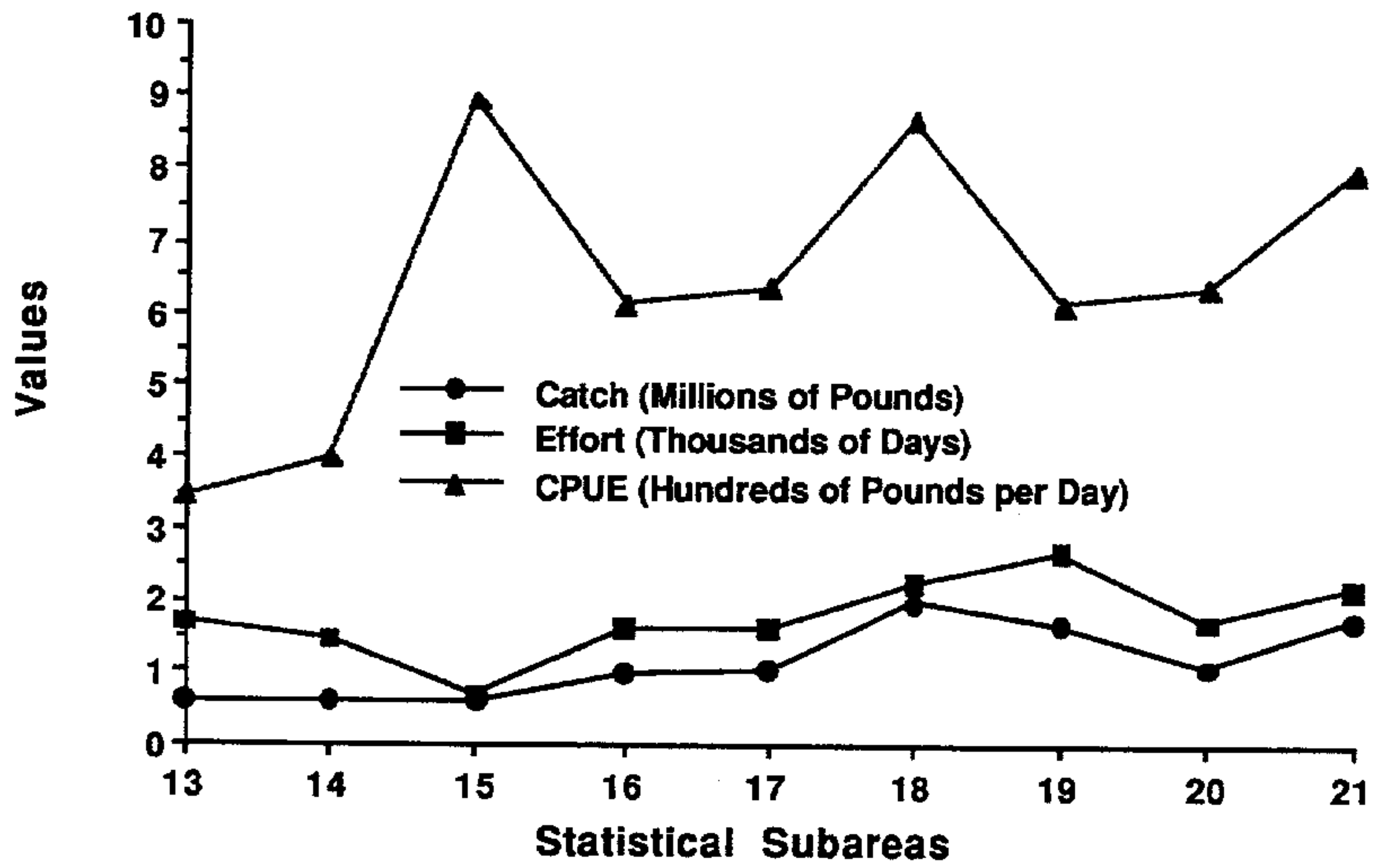


Figure 3. Offshore brown shrimp catch, effort and CPUE values during July 1992.

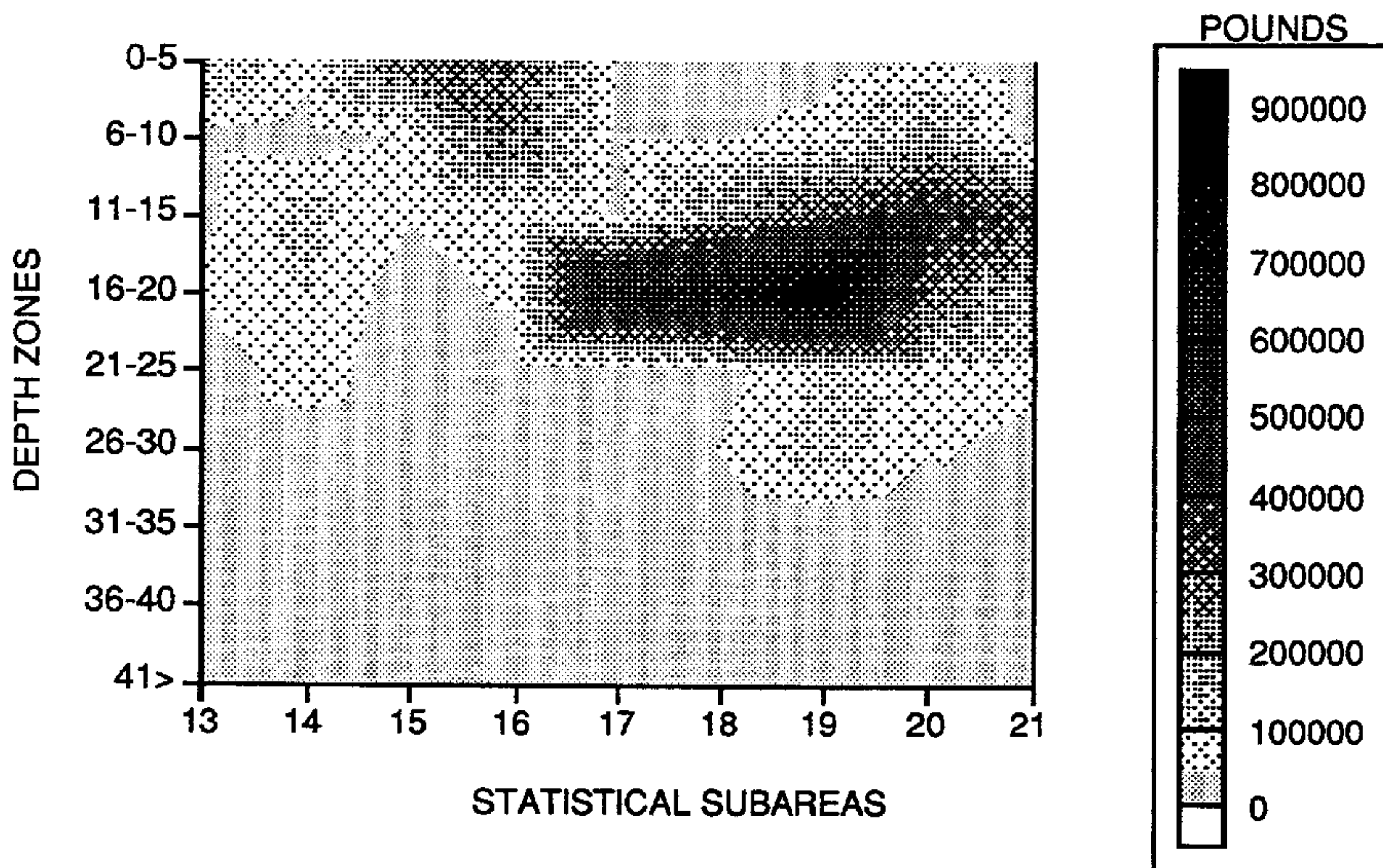
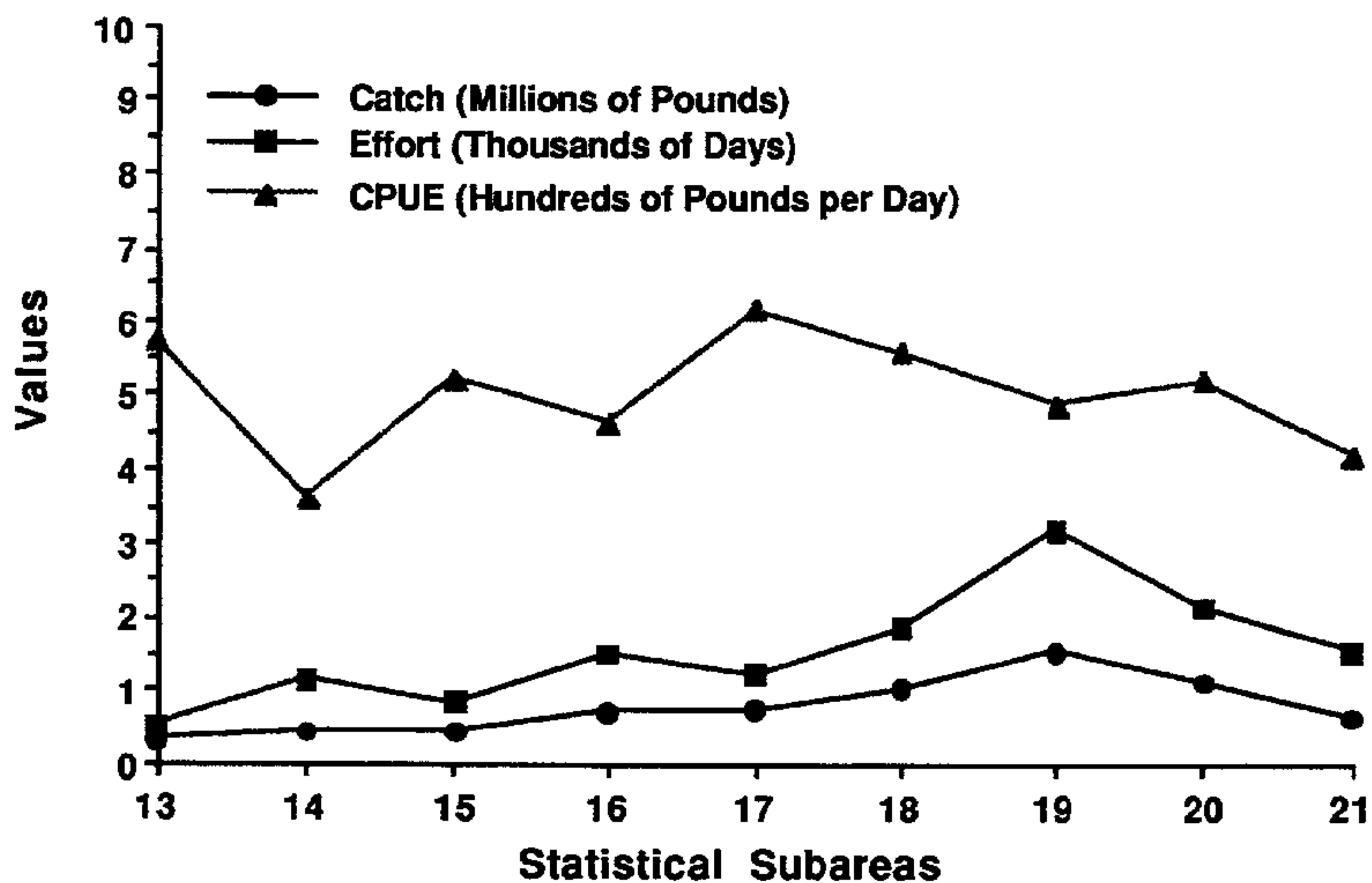


Figure 4. Offshore brown shrimp catch, effort and CPUE values during August 1992.



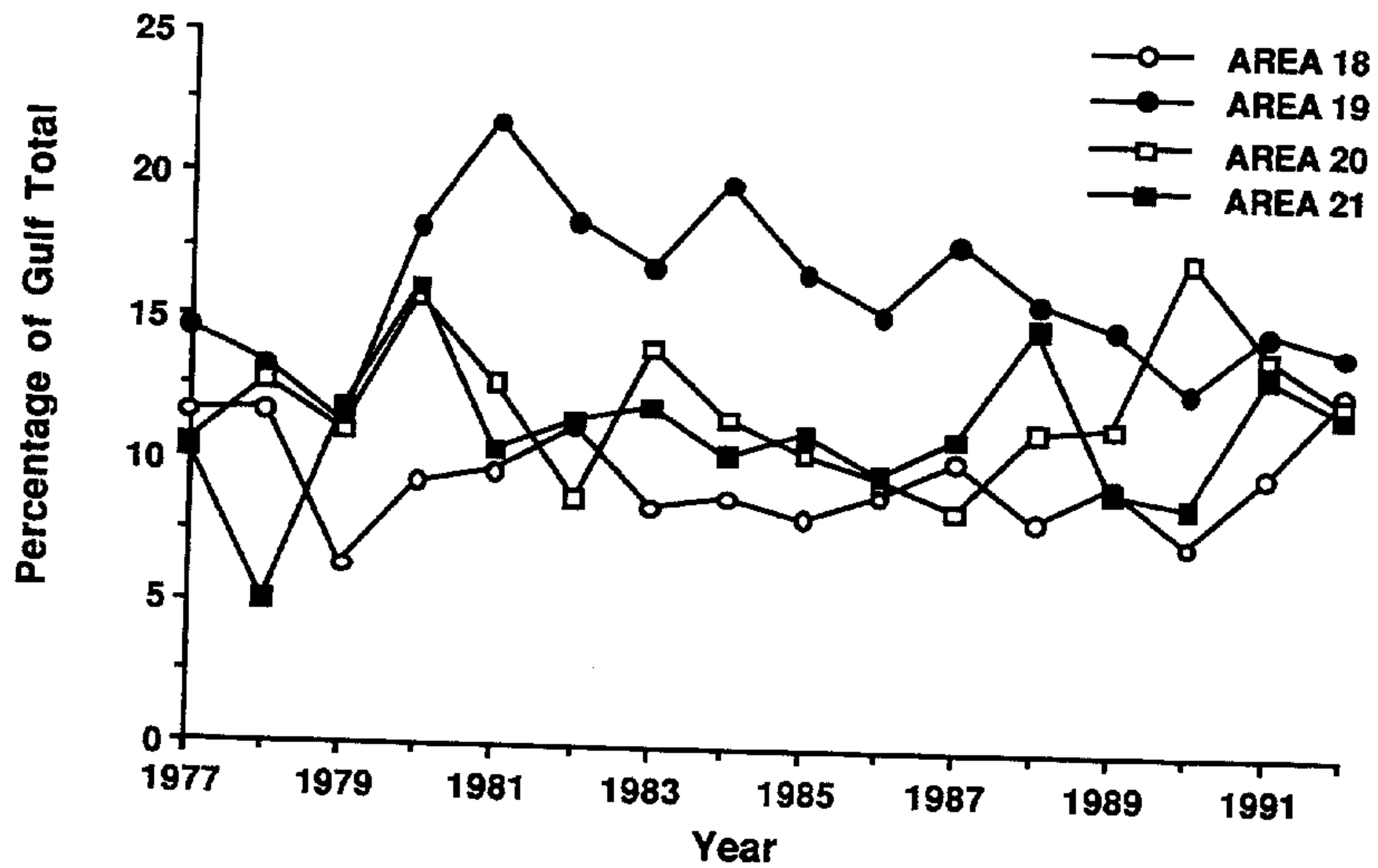


Figure 5. Percent of total Gulf of Mexico brown shrimp catch taken from the offshore waters of Texas.

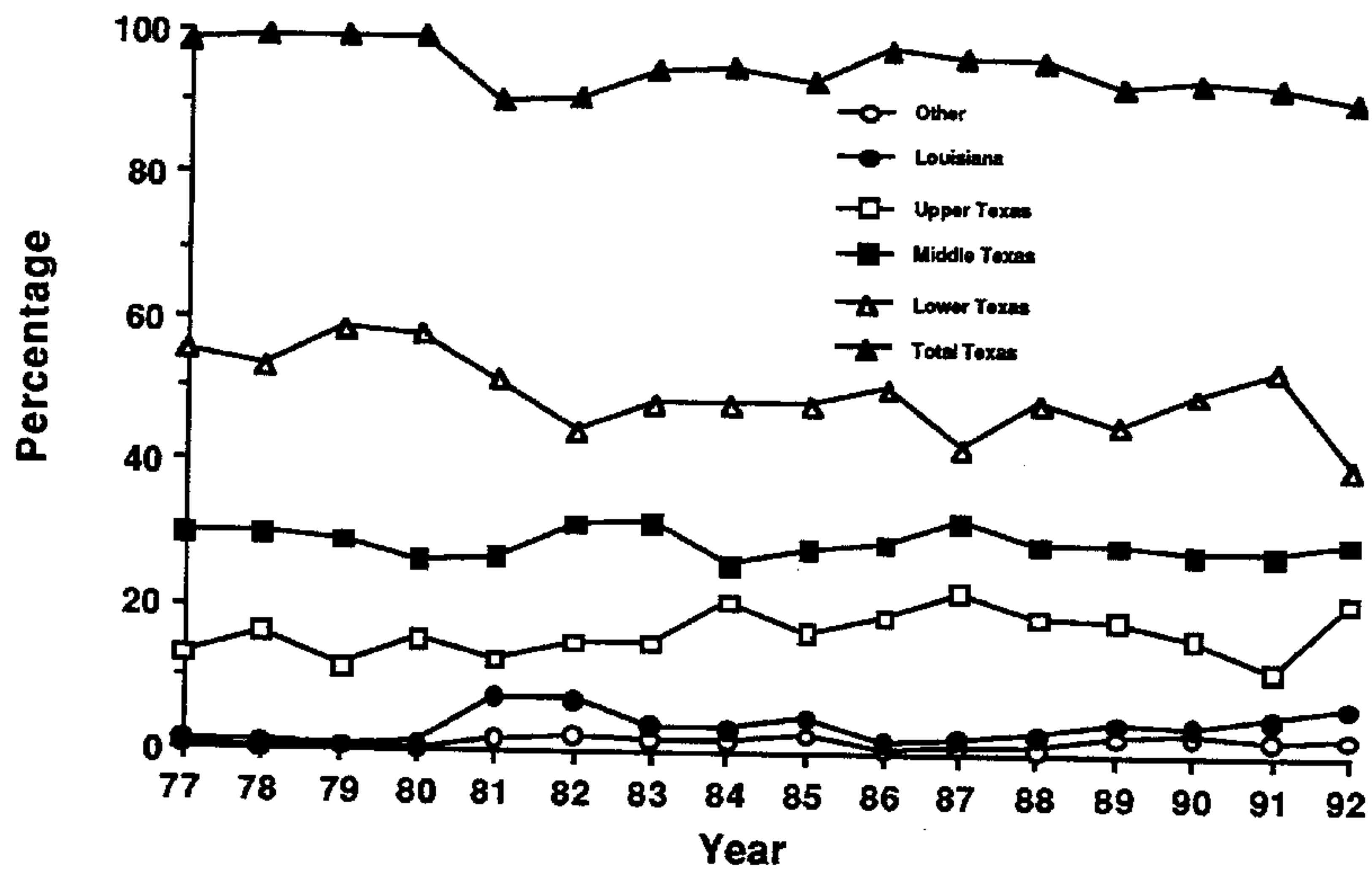


Figure 6. Distribution of May - August total shrimp catch from Texas waters, 1977 - 1992.

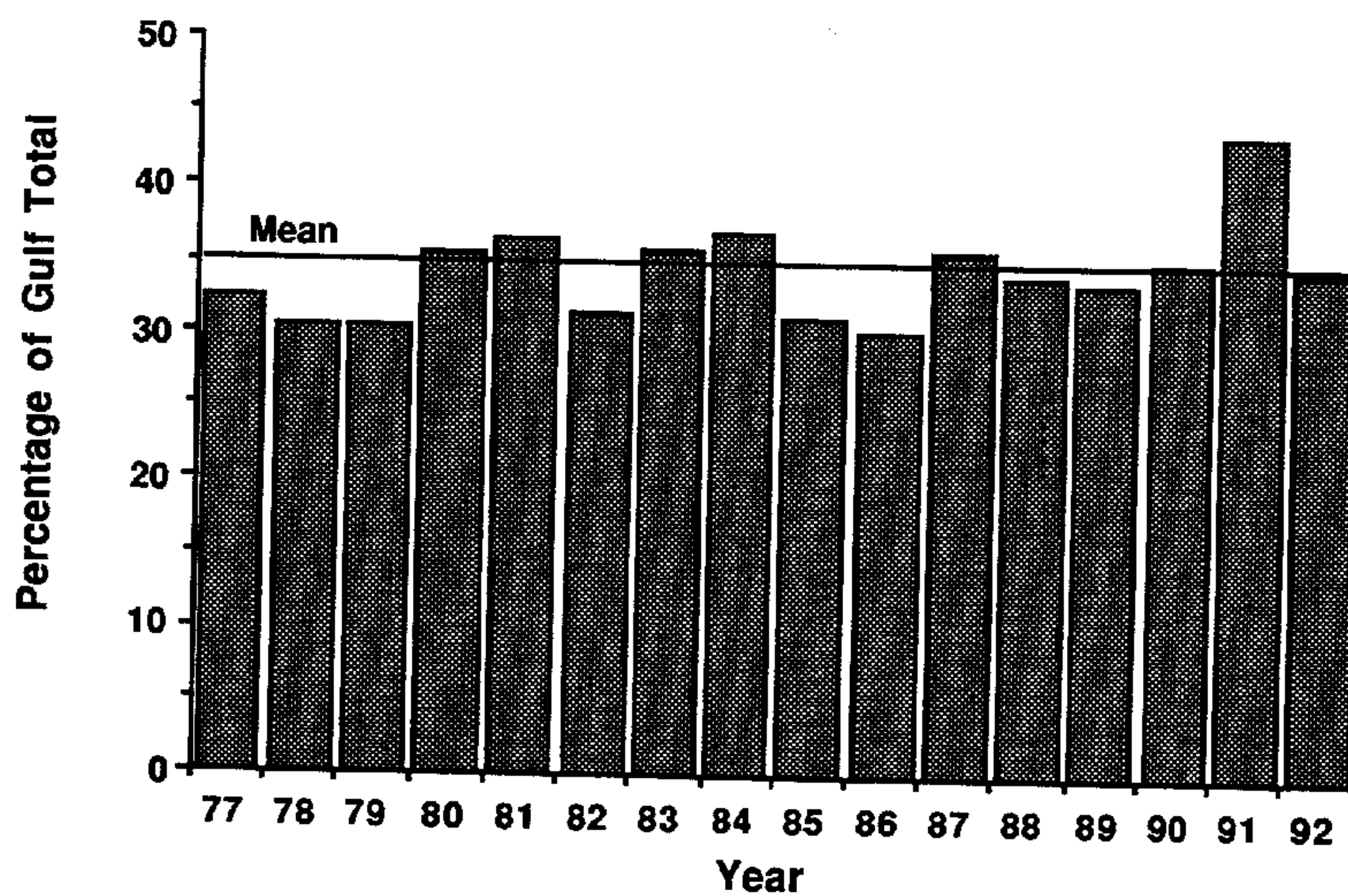


Figure 6. Distribution of May - August Gulf of Mexico shrimp production to all Texas ports, 1977 - 1992.



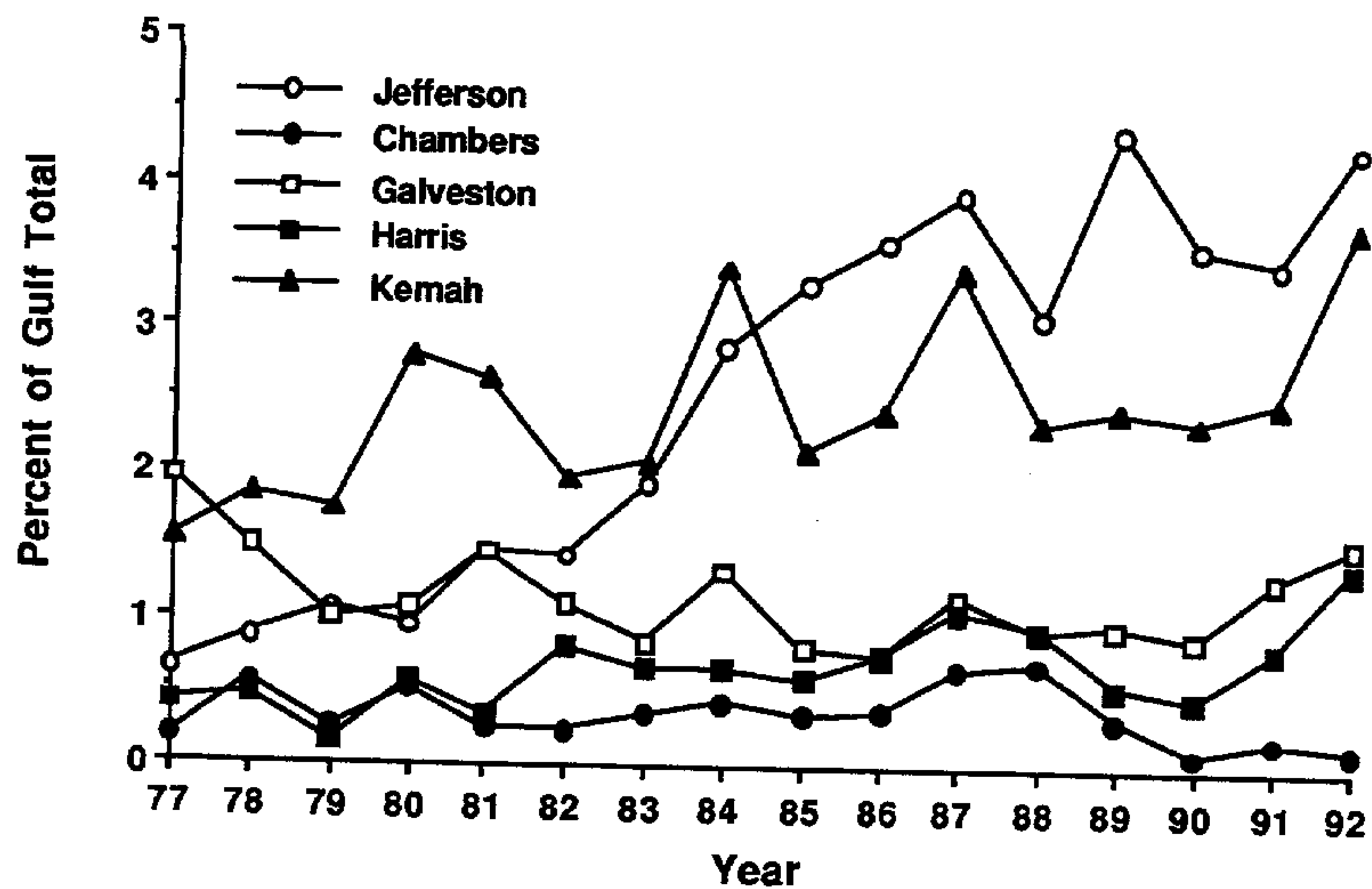


Figure 8. Distribution of May - August Texas landings by upper coast ports, 1977 - 1992.

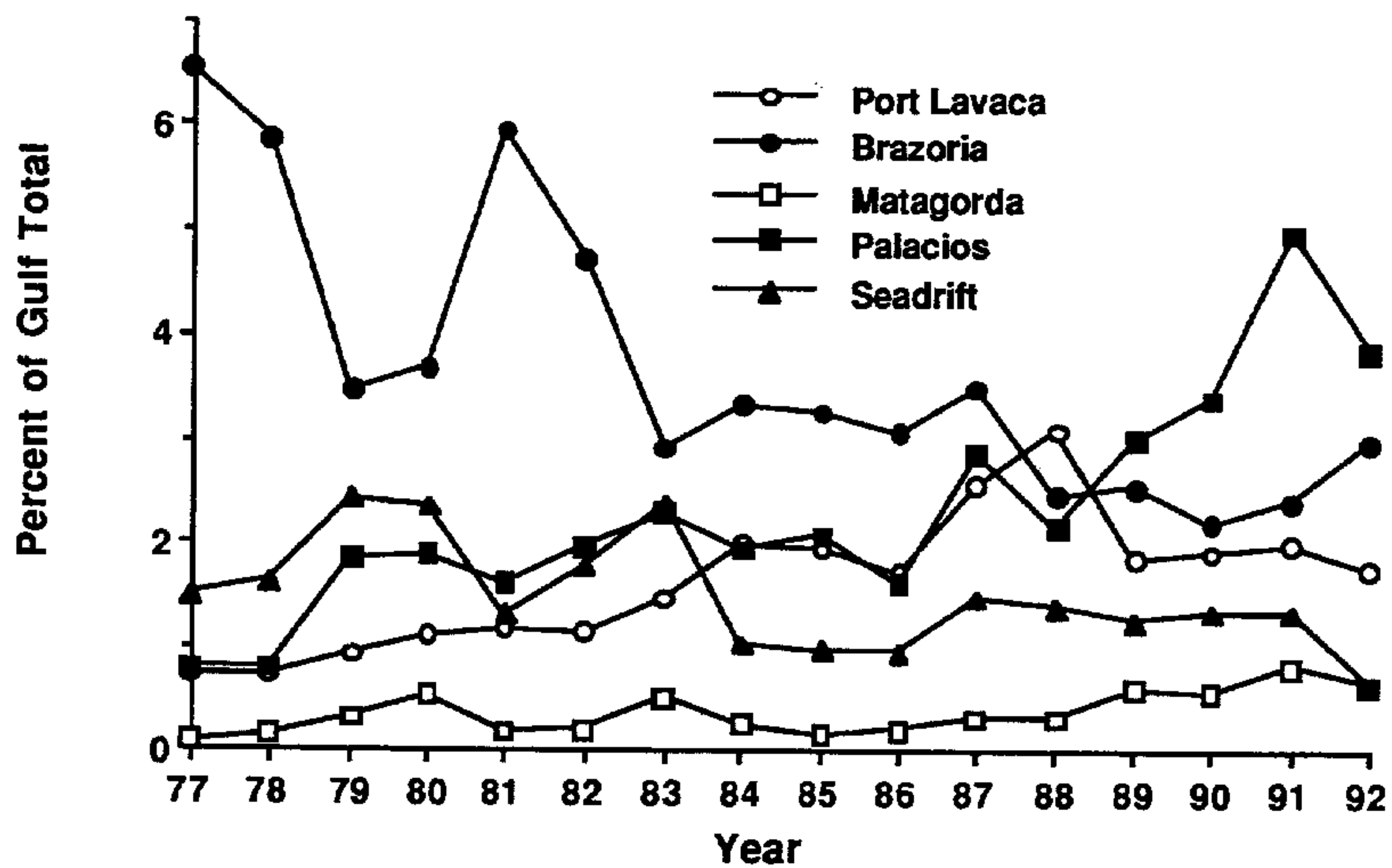


Figure 9. Distribution of May - August Texas landings by middle coast ports, 1977 - 1992.

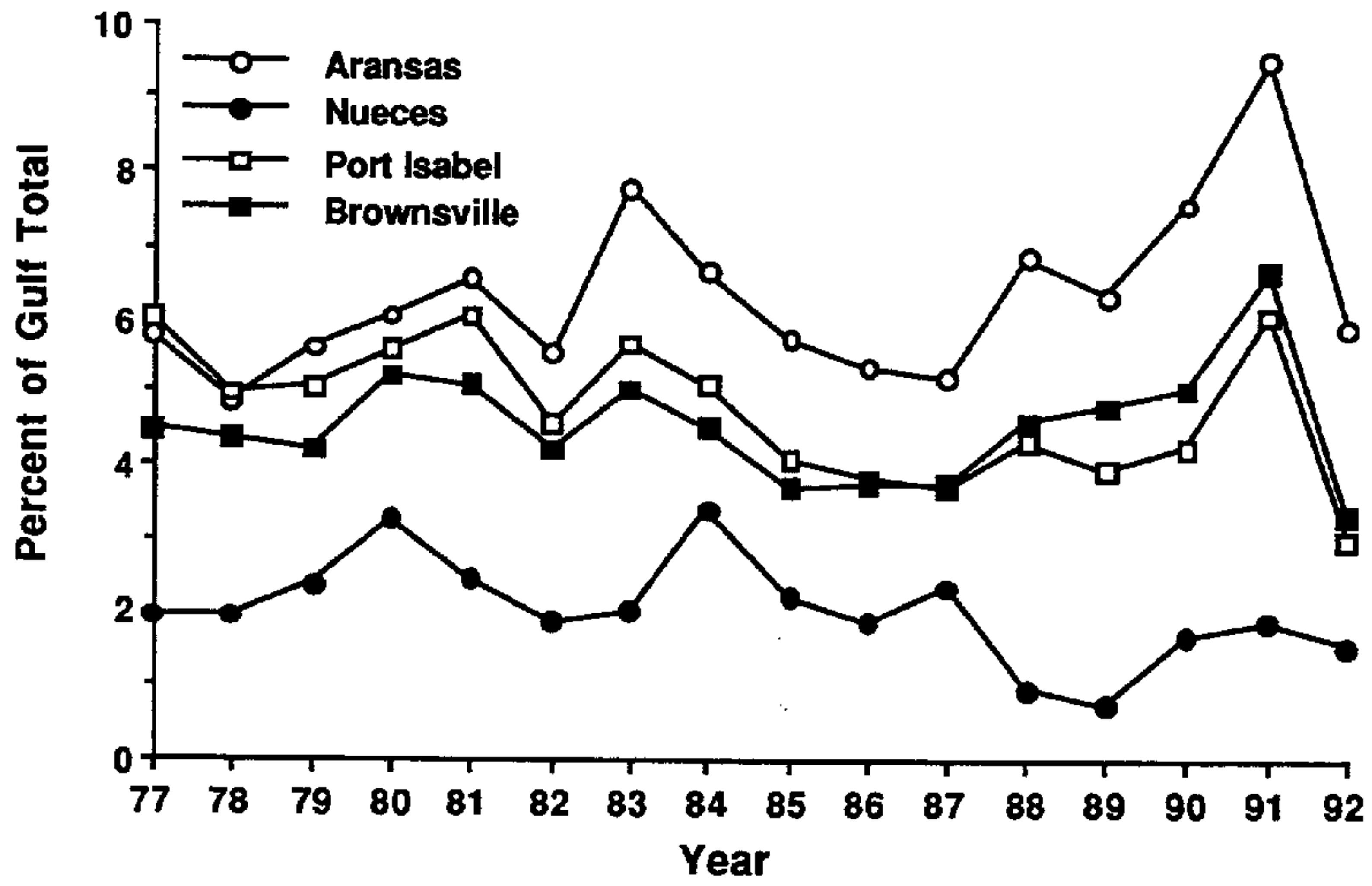


Figure 10. Distribution of May - August Texas landings by lower coast ports, 1977 - 1992.



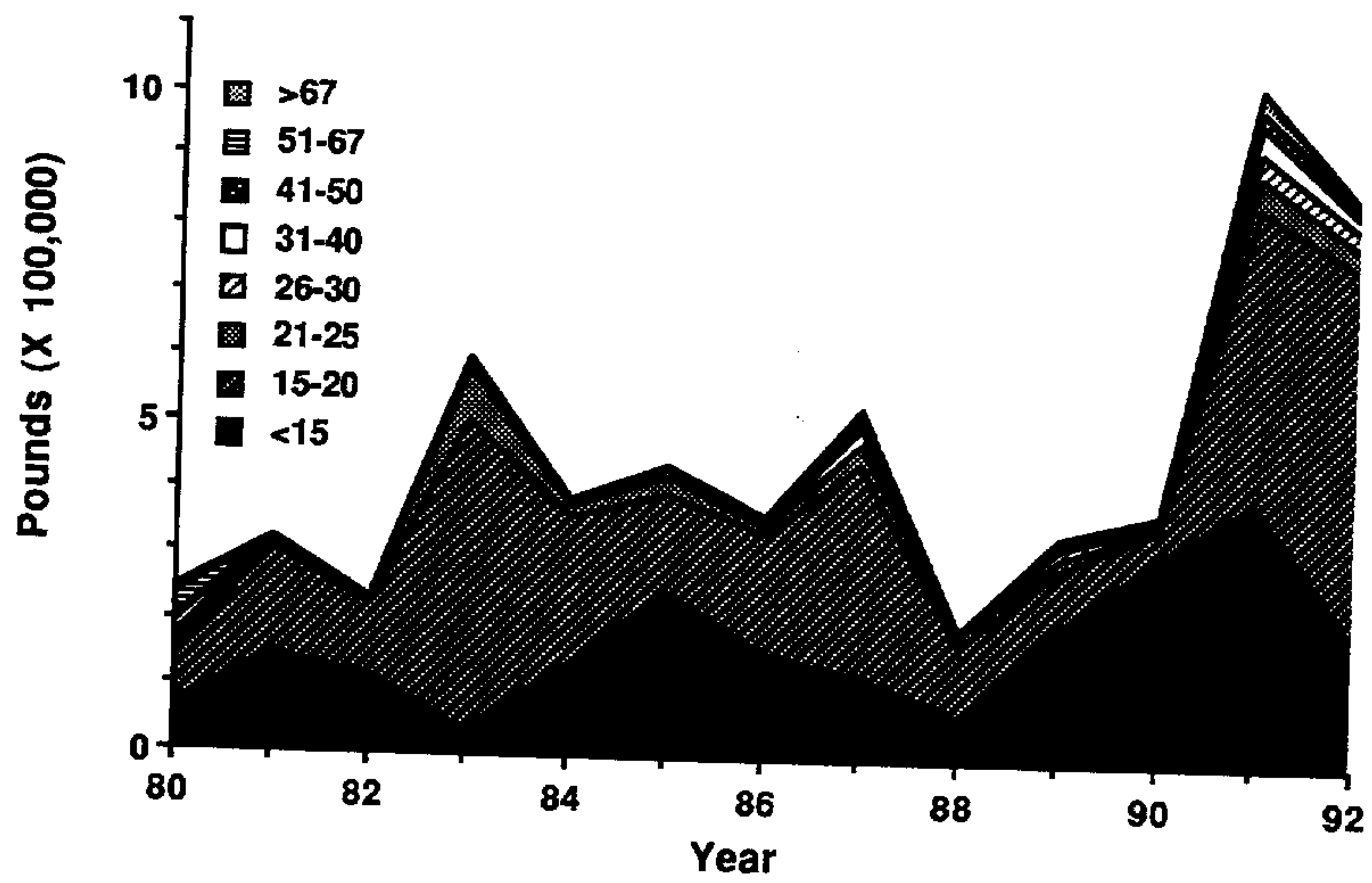


Figure 11. White shrimp size distribution off the Texas coast from 1980 - 1992 during July.

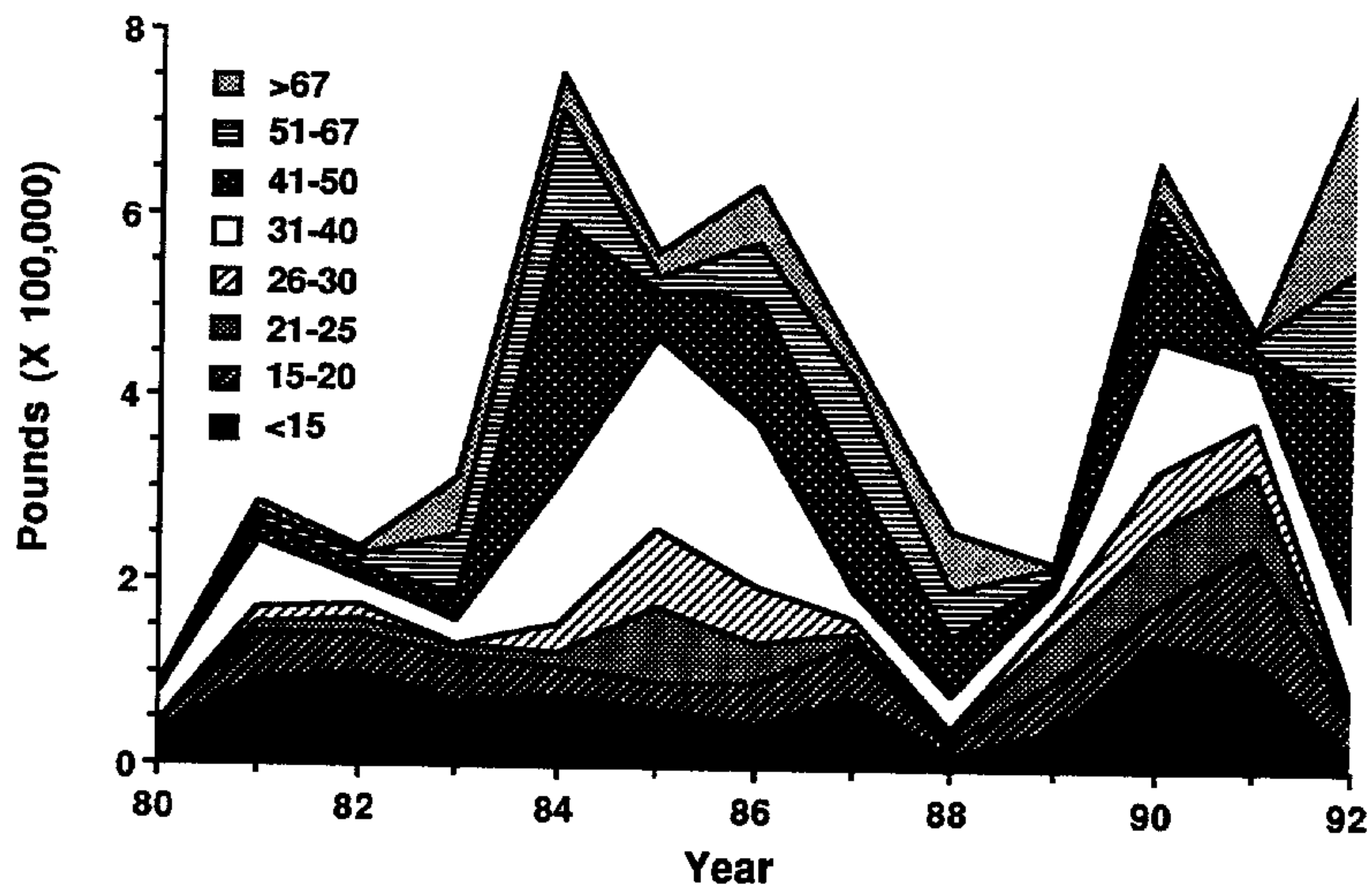


Figure 12. White shrimp size distribution off the Texas coast from 1980 - 1992 during August.